

In The Claims:

1. A method for generating hydrogen from a metal hydride comprises the steps of:

 providing a fuel containing a metal hydride and water;

 catalyzing a reaction of the metal hydride and water by using a functional membrane system; and thereby generating hydrogen.
2. The method of Claim 1 wherein said functional membrane system comprises:

 a membrane; and

 a catalyst adapted to promote the removal of hydrogen from a metal hydride, said catalyst being contained in said membrane.
3. The method of Claim 2 wherein said catalyst being a transition metal catalyst.
4. The method of Claim 3 wherein said transition metal catalyst containing Group IB to Group VIIIB metals of the Periodic Table or compounds made thereof.

5. The method of Claim 4 wherein said transition metal catalyst being selected from ruthenium, cobalt, ruthenium compounds, cobalt compounds, and combinations thereof.

6. The method of Claim 2 wherein said method further comprises:

- a hydrophilic layer;
- a metallic catalyst layer; and
- a microporous diffusion layer.

7. The method of Claim 6 wherein said hydrophilic layer and said metallic catalyst layer comprise a single layer.

8. The method of Claim 7 wherein said single layer being a coating on said microporous diffusion layer.

9. The method of Claim 6 wherein said metallic catalyst layer and said microporous diffusion layer being a single layer.

10. The method of Claim 9 wherein said catalyst being embedded in said microporous diffusion layer.

11. The method of Claim 6 wherein said hydrophilic layer being coated on said metallic catalyst layer.

12. The method of Claim 6 wherein said metallic catalyst layer being affixed on said microporous diffusion layer by a process selected from the group consisting of vapor deposition, ionic bonding, and electrostatic bonding.

13. The method of Claim 2 wherein said membrane being a flat sheet or a hollow fiber.

14. The method of Claim 2 wherein said membrane being an asymmetric membrane.

15. The method of Claim 14 wherein said asymmetric membrane having a skin.

16. The method of Claim 2 wherein said functional membrane system further comprises a plurality of functional membrane systems.

17. The method of Claim 16 wherein said plurality of functional membrane systems comprises a bundle of hollow fibers.

18. A reactor for generating hydrogen comprises:

a vessel; and

a functional membrane system disposed within said vessel so that two chambers are formed within said vessel, one said chamber being a fuel chamber and said other chamber being a hydrogen chamber, whereby when a fuel containing a metal hydride and water are introduced to said fuel chamber, said fuel being catalytically reacted to form hydrogen and said hydrogen passing through said functional membrane system to said hydrogen chamber.

19. The reactor of Claim 18 wherein said functional membrane system further comprises a bundle of hollow fiber functional membrane systems.

20. The reactor of Claim 18 wherein said functional membrane system comprises:

a membrane; and

a catalyst adapted to promote the removal of hydrogen from a metal hydride, said catalyst being contained in said membrane.

21. The reactor of Claim 20 wherein said catalyst being a transition metal catalyst.

22. The reactor of Claim 21 wherein said transition metal catalyst containing Group IB to Group VIIIB metals of the Periodic Table or compounds made thereof.

23. The reactor of Claim 22 wherein said transition metal catalyst being selected from ruthenium, cobalt, ruthenium compounds, cobalt compounds, and combinations thereof.

24. The reactor of Claim 20 further comprises:

- a hydrophilic layer;
- a metallic catalyst layer; and
- a microporous diffusion layer.

25. The reactor of Claim 24 wherein said hydrophilic layer and said metallic catalyst layer comprise a single layer.

26. The reactor of Claim 25 wherein said single layer being a coating on said microporous diffusion layer.

27. The reactor of Claim 24 wherein said metallic catalyst layer and said microporous diffusion layer being a single layer.

28. The reactor of Claim 27 wherein said catalyst being embedded in said microporous diffusion layer.

29. The reactor of Claim 24 wherein said hydrophilic layer being coated on said metallic catalyst layer.

30. The reactor of Claim 24 wherein said metallic catalyst layer being affixed on said microporous diffusion layer by a process selected from the group consisting of vapor deposition, ionic bonding, and electrostatic bonding.

31. The reactor of Claim 20 wherein said membrane being a flat sheet or a hollow fiber.

32. The reactor of Claim 20 wherein said membrane being an asymmetric membrane.

33. The reactor of Claim 32 wherein said asymmetric membrane having a skin.

34. The functional membrane system of Claim 20 wherein said functional membrane system further comprises a plurality of functional membrane systems.

35. The functional membrane system of Claim 34 wherein said plurality of functional membrane systems comprises a bundle of hollow fibers.

36. A functional membrane system comprises:
a membrane; and
a catalyst adapted to promote the removal of hydrogen from a metal hydride, said catalyst being contained in said membrane.

37. The functional membrane system of Claim 36 wherein said catalyst being a transition metal catalyst.

38. The functional membrane system of Claim 37 wherein said transition metal catalyst containing Group IB

to Group VIIIIB metals of the Periodic Table or compounds made thereof.

39. The functional membrane system of Claim 38 wherein said transition metal catalyst being selected from ruthenium, cobalt, ruthenium compounds, cobalt compounds, and combinations thereof.

40. The functional membrane system of Claim 36 further comprises:

- a hydrophilic layer;
- a metallic catalyst layer; and
- a microporous diffusion layer.

41. The functional membrane system of Claim 40 wherein said hydrophilic layer and said metallic catalyst layer comprise a single layer.

42. The functional membrane system of Claim 41 wherein said single layer being a coating on said microporous diffusion layer.

43. The functional membrane system of Claim 40 wherein said metallic catalyst layer and said microporous diffusion layer being a single layer.

44. The functional membrane system of Claim 43 wherein said catalyst being embedded in said microporous diffusion layer.

45. The functional membrane system of Claim 40 wherein said hydrophilic layer being coated on said metallic catalyst layer.

46. The functional membrane system of Claim 40 wherein said metallic catalyst layer being affixed on said microporous diffusion layer by a process selected from the group consisting of vapor deposition, ionic bonding, and electrostatic bonding.

47. The functional membrane system of Claim 36 wherein said membrane being a flat sheet or a hollow fiber.

48. The functional membrane system of Claim 36 wherein said membrane being an asymmetric membrane.

49. The functional membrane system of Claim 48 wherein said asymmetric membrane having a skin.

50. The functional membrane system of Claim 36 wherein said functional membrane system further comprises a plurality of functional membrane systems.

51. The functional membrane system of Claim 50 wherein said plurality of functional membrane systems comprises a bundle of hollow fibers.